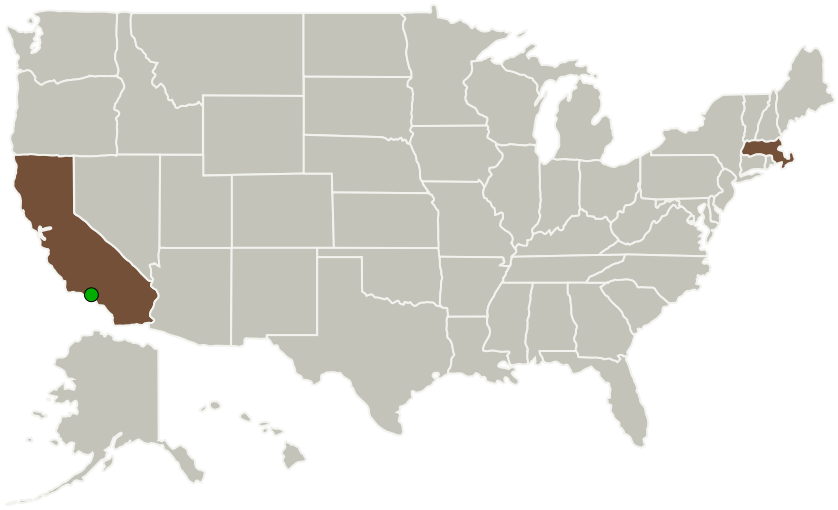
Enhanced Fabrication Processes Development for High Actuator Count Deformable Mirrors, Phase I

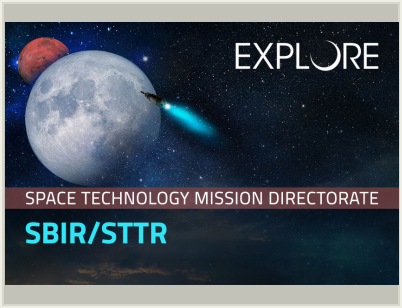
Completed Technology Project (2010 - 2010)

Project Introduction

It is proposed to advance manufacturing science and technology to improve yield and optical surface figure in high actuator count, high-resolution deformable mirrors (DM) required for wavefront control in space-based high contrast imaging instruments. As the scale of batch fabricated, polysilicon surface micromachined MEMS DMs increases to thousands of actuators the associated increase in devices size limits the achievable yield due to micro-scale defects introduced during the manufacturing processes and large unpowered surface figure errors. In Phase I research, major obstacles preventing scalability of microfabrication processes to large arrays will be overcome by developing a polysilicon deposition process to reduce and control defect density to maximize the yield of a 1027 segment Tip-Tilt Piston DM with 3081 actuators and to determine the practical limits of the tool set and compatibility of this process for the manufacture of MEMS DMs with >104 actuators. Manufacturing processes to minimize unpowered surface figure errors will be developed to (1) reduce substrate curvature induced DM surface figure errors through control of deposition and polishing processes to balance the front and backside film thickness, and (2) reduce polishing induced DM surface figure errors by modifying the device wire routing layout design to maintain uniform pattern density across the device area to achieve uniform material removal rates in the polishing process. Successful completion of the Phase 1 work will enable the design and manufacture of a 1027 Tip-Tilt-Piston deformable mirror required for NASA's visible nulling coronagraph instrument in a Phase 2 effort.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Boston Micromachines Corporation	Lead Organization	Industry	Cambridge, Massachusetts
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations	
California	Massachusetts

Project Transitions

January 2010: Project Start

July 2010: Closed out

Closeout Summary: Enhanced Fabrication Processes Development for High Act uator Count Deformable Mirrors, Phase I Project Image

Closeout Documentation:

- Final Summary Chart Image*(https://techport.nasa.gov/file/140017)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Boston Micromachines Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

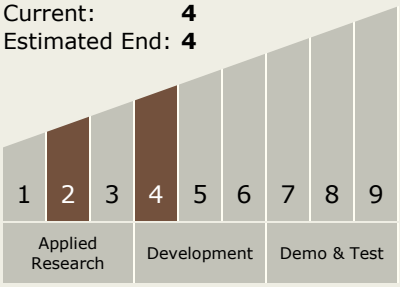
Carlos Torrez

Principal Investigator:

Stevn Cornelissen

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



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Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.2 Observatories
    - TX08.2.1 Mirror Systems

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System